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Selected Urban Storm Water Runoff Abstracts

First Quarterly Issue

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Continued on inside back cover....

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ABSTRACT

The first quarterly supplement to SELECTED URBAN STORM WATER RUNOFF ABSTRACTS is a compilation of abstracts summarizing articles from a variety of technical literature concerning the problem of urban drainage published from July 1970 through September 1970. The 36 abstracts covering a range of eight sections are arranged alphabetically by author and numerically by abstract number within each category. Each item includes a bibliographic citation, an abstract, and a set of indexing descriptors and identifiers. A cumulative subject index at the end of the volume provides the necessary access to individual concepts. An author index and a journal list are also included.

This work was submitted in fulfillment of Contract 14-12-904 between the Federal Water Quality Administration and the Franklin Institute Research Laboratories.

Key Words: Storm runoff, drainage, sewers, water pollution control.

FOREWORD

The first quarterly supplement to SELECTED URBAN STORM WATER RUNOFF ABSTRACTS is a compilation of abstracts summarizing articles from a variety of technical publications covering subjects pertinent to the problem of urban drainage. There was no reported material solely related to the following sections: sewer hydraulics, combined sewers, or storm water - quality, quantity, and pollution.

The present work includes 36 abstracts of documents published for the most part from July 1970 through September 1970. For convenience, the abstracts are classed in eight categories and arranged alphabetically by author and numerically by abstract number within each category. Since most of the papers fit into more than one category, a cumulative subject index at the end of the volume provides the necessary access to individual concepts and should be utilized for locating all abstracts in which this concept is significant. The numbers following an index term are the numbers for the abstracts in which this term is found. Each item includes a bibliographic citation, an abstract, and a set of indexing descriptors (subject terms listed in the WATER RESOURCES THESAURUS, November 1966 edition) and identifiers (newly suggested index terms). The most important index terms are marked by an asterisk. An author index and journal list are included for the reader's benefit.

Copies of the articles abstracted in most cases can be obtained from research libraries covering water pollution or public health engineering literature.

Suggestions concerning the improvement of content and format, or expansion of subject coverage in future supplements will be gratefully received.

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SECTION 1.

Construction: Equipment and Materials;
and Instrumentation

001
NEW EQUIPMENT--PRIMARY WATER TREATMENT AIDED BY COMPACT SEPARATOR,

Chemical Eng, Vol 77, No 15, pp 48 and 50, Jul 13, 1970. 1 diag.

Descriptors: *Pollution abatement, *Sewage treatment, *Equipment.
Identifiers: *Wastewater Concentrator, *Screen separator.

The Wastewater Concentrator takes up little space but has the capacity to screen sudden overloads of raw sewage (2,000-3,000 gpm) during rainfall. It provides standby primary treatment by screening influent and then collecting it in an annular chamber and directing it to a discharge box at the bottom of the unit. Materials not passed discharge through a 10-inch pipe. The workings, operating cycle, and advantages of the unit are described.

002
GRID FOR RETAINING LARGE COMPONENTS OF SEWAGE IN SEWAGE PUMPING EQUIPMENT,

Neth Patents +NL 6817241.

Descriptors: *Patents, *Sewage.
Identifiers: *Pumping equipment, *Retaining grid.

The grid is designed for insertion in a pipeline and for cleaning by backwashing. It is fabricated from a series of initially parallel plates bonded to the pipe wall at the edges. The dimensions are such that their axial length is at least 8 times the interplate spacing.

003
CATCHBASINS CLEANED FOR $3.00,

Public Works, Vol 101, No 8, p 81, Aug 1970. 2 fig.

Descriptors: *Cleaning, *Maintenance, Cost comparisons.
Identifiers: *Suction machine, *Teaneck, New Jersey.

Teaneck, New Jersey's switch from bucket cleaning of catchbasins to

suction cleaning with a Good Roads Scavenger has reduced costs of the twice-a-year job by 80%. The rate of catchbasin cleaning has also increased considerably. The suction machine is also used to clean out manholes, to clean streets, and to pick up and dispose of leaves on streets and park grounds during autumn.

004
WASHED OUT ROAD REOPENED QUICKLY,

Public Works, Vol 101, No 8, p 84, Aug 1970. 3 fig.

Descriptors: *Construction, *Steel pipes, *Installation, *Construction materials.

This article describes how a concrete slab deck culvert, destroyed by a flash flood, was replaced in only eleven working days with two 90-inch corrugated galvanized steel pipes. The contractor laid the pipe employing all standard practices except for the special borrow gravel used for the entire fill. It is normally used only halfway up the pipe.

005
GUNITE GIVES NEW LIFE ... to an old, falling brick sewer system,

William M. Englerth
Am City, Vol 85, No 7, pp 101-102, Jul 1970.

Descriptors: *Sewers, *Construction, *Gunite, Repairing, Costs.
Identifiers: *Chattanooga, Tennessee, Sewer lining, Capacity.

A visual inspection of the brick sewer system in Chattanooga, Tennessee resulted in its rehabilitation with pneumatically applied reinforced concrete lining, known as gunite. This repair method reduces the carrying capacity; however, the newly lined surface reduces many existing friction losses in the deteriorating conduit, and capacity in the repaired sewer is increased from the higher flow velocities. A total of $633,113.70 was needed to repair the main brick sewers in the downtown area of Chattanooga.

006
"BEEHIVES" PROTECT SNOW-REMOVAL SALT AND PREVENT WATER POLLUTION,

John R. Fitzpatrick
Am City, Vol 85, No 9, pp 81-83, Sep 1970.

Descriptors: *Control structures, *Structures, *Construction, *Structural design, Water pollution sources.
Identifiers: *Canada.

Salt-sand piles, used as storage for a road clearing mixture during winter months in Ontario and subject to leaching by rain, will be covered so as to lessen this potential source of contamination. This article discusses the construction materials, the design dimensions, and the methods of erection for the 20 sided, cone-shaped storage structure.

SECTION 2.

Overflows and Regulation Devices

007
TECHNOLOGY: TEST COMBINED SEWER TREATMENT,

Modern Power Eng, Vol 64, No 8, p 33, Aug 1970.

Descriptors: *Sewers, *Sewage treatment, *Treatment facilities, Overflow.
Identifiers: *Combined sewers, *Storm sewers, *Storm overflows, Racine, Wisconsin.

Racine, Wisconsin is the test area for a system of satellite sewage treatment plants designed to eliminate the need for separating storm and sanitary sewers. The process involves five satellite plants which will treat the discharge from the combined sewer overflow during periods of heavy runoff. A screen/dissolved air flotation unit will remove inorganic pollutants and suspended solids from the combined sewer overflow.

008
COMPUTER CONTROL OF COMBINED SEWERS,

James J. Anderson
Saint Paul, Minneapolis; Watermation, Inc, Oct 1969. 19 p, 26 fig, 8 tab, 22 ref.

Descriptors: *Automatic control, *Computers, *Regulated flow, *Control systems, *Pollution abatement, *Surface runoff, *Flow control, Sewers.
Identifiers: *Combined sewers, *Minneapolis - Saint Paul Sanitary District, *Urban runoff.

This paper describes a unique application of digital computers for maximizing the capture of urban runoff in the combined sewer system of the Minneapolis - St. Paul Sanitary District. The real-time dynamic computer control of system overflow-regulators proved effective in helping to increase flows in interceptor sewers, thus reducing the frequency of overflows of raw sewage to the Mississippi River. Major overflow regulators were modified by replacing floats on the gates with hydraulic cylinders. Inflatable dams were installed in trunk sewer outlets. Level-sensing bubbler tubes with transducers and gate position slidewires were installed to provide sewer level and regulator status information. Control and telemetry equipment were installed in underground vaults. The data acquisition and control system provides both manual-remote and automatic control of the system by central computer using leased telephone wires. The author describes the river monitoring and wastewater sampling methods employed, the rain gage installations, mathematical modeling, and operating methods. He concludes that the feasibility of controlling and operating a large combined sewer system,

using centralized computer control, has been demonstrated and that this data acquisition system will facilitate future testing of improvements in water resource management.

SECTION 3.

Sewer Hydraulics

THERE ARE NO ABSTRACTS FOR THIS SECTION OF THE FIRST QUARTERLY ISSUE DUE TO A LACK OF INFORMATION PERTINENT TO THIS CATEGORY.

SECTION 4.

Sewer Systems

4a. Combined

THERE ARE NO ABSTRACTS FOR THIS SUB-SECTION OF THE FIRST QUARTERLY ISSUE DUE TO A LACK OF INFORMATION PERTINENT TO THIS CATEGORY.

4b. Sanitary

009
RENEWAL IS VALID TERM IN BOSTON,

Public Works, Vol 101, No 7, pp 70-71, Jul 1970.

Descriptors: *Separation techniques, *Sewerage, *Storm drains, Construction materials, Urban renewal.
Identifiers: *Boston, Massachusetts, *Sanitary sewers.

As part of the Bay Village urban renewal project in Boston, the old sanitary and storm drain system was replaced with separate systems. Asbestos-cement pipes were used for the first time in Boston for the sanitary sewer. Reinforced concrete was used for the new storm drain, which parallels the sanitary sewer. Other public improvements in this area include resurfacing of streets, renewal of underground facilities, and installation of brick sidewalks and gas lamps.

010
SEWERAGE PRACTICES IN THE GULF COAST AREA,

John K. Mayer, Frank W. MacDonald, and Stephen E. Steimle
Public Works, Vol 101, No 8, pp 71-72, Aug 1970.

Descriptors: *Sewers, *Surveys, *City planning, Construction materials, Pipelines, Infiltration, Water table, Average flow.
Identifiers: *Sanitary sewers, *Gulf Coast, Treatment methods.

For the purpose of obtaining background information on sanitary sewers in the Gulf Coast areas, 71 municipalities and sewer districts spanning the coast from Texas through Florida were canvassed by questionnaire during the latter part of 1967 and the early part of 1968. The article

describes the following results obtained from the survey: 1) type of sewers, 2) length of sewers, 3) pipe construction materials, 4) type of bedding used, 5) infiltration experience, 6) soil description and depth of water table, and 7) average flow and treatment used.

011
INFILTRATION IN SEPARATE SANITARY SEWERS; Determination, Economic Cost, and Correction Methods,

W. G. Riddle
J Water Pollution Control Fed, Vol 43, No 9, pp 1676-1683, Sep 1970. 4 fig.

Descriptors: *Pollution abatement, *Surveys, *Storm runoff, *Infiltration.
Identifiers: *Sanitary sewers, *Infiltration remedies.

The author has investigated the matter of eliminating both infiltration and stormwater which are serious pollution and economic problems afflicting most sanitary sewer systems. He contends that the elimination of stormwater from separate sanitary sewage systems is relatively easy, inexpensive, straightforward, and requires mainly education and effort. At the same time, reduction of infiltration is found to be more difficult and expensive. Several developments for reducing leakage that are less expensive than reconstruction include: two leak reduction methods, localized pressure grouting, and recent developments in testing and detector devices (for example low pressure air testing, and a 35-mm color camera).

4c. Storm

012
STORM SEWER ASSESSMENTS,

Richard R. Dague
Public Works, Vol 101, No 8, pp 62-66, 118, Aug 1970. 2 fig, 2 ref.

Descriptors: *Cost-benefit analysis, *Assessments, Runoff coefficient, Rainfall intensity, Drainage districts, Costs.
Identifiers: *Des Moines, Iowa, *Storm sewers.

The author presents a method of storm sewer assessment which was applied to a project in Des Moines, Iowa. Four benefit factors considered in apportioning property costs can be utilized in storm sewer assessment if the relative weight of each factor is determined by the relative benefit to be accrued. Other factors to be considered reflecting costs and therefore benefit are: (1) the area drained, (2) the runoff coefficient, (3) the rainfall intensity, (4) the distance to the outlet, (5) the unit pipe cost, and (6) the slope of the sewer.

Each of these factors are discussed in relation to a sub-area. Once the dollar benefit to each sub-area is determined, the benefit to individual properties within sub-areas must be ascertained. Also, in arriving at storm sewer assessment, the benefit accruing to public property must be considered. Means for evaluating all of these factors are thoroughly described. The Des Moines procedure outlined in this article does not necessarily have application to all storm sewer special assessment problems. The test of the method will come through its application to a variety of storm sewer assessment problems along with success in the courts.

013
STORM SEWER DESIGN,

F. D. Rickman
Paper presented at the National Conference Committee on Electronics, American Association of State Highway Officials, Austin, Texas, May 7-8, 1968. 23 p.

Descriptors: *Computers, *Computer programs, *Design, *Design criteria, Sewers.
Identifiers: *Storm sewers, *Storm sewer design.

The Fortran program was developed to design storm sewers from the basic data of rainfall, drainage areas, and pipe slopes and lengths. Storm sewer design lends itself to a computer operation because of the repetitive calculations involved in designing a complicated system of interconnected pipes. A program has been written in Fortran II for the IBM 1620 computer; a program for output listing was written for the IBM 1401 computer to give a better presentation to the designer and engineer. The storm sewer program is now being converted from Fortran II to Fortran IV.

014
RATIONAL "RATIONAL" METHOD OF STORM DRAINAGE DESIGN,

Richard A. Rogers (discussion)
J Irrigation Drainage Div, Am Soc Civil Engrs, Vol 96, No IR3, pp 342-343, Sep 1970.

Original Paper: RATIONAL "RATIONAL" METHOD OF STORM DRAINAGE DESIGN,
Richard A. Rogers
J Irrigation Drainage Div, Am Soc Civil Engrs,
Vol 94, No IR4, pp 465-480, Dec. 1968.

Descriptors: *Storm drains, *Flow rates, Computer programs, Methodology, Drainage systems, Design.

The writer has thus far been unable to comprehend, for the extreme case of a submerged storm system and assumed incompressible water, how

the rate of flow out of the system at the outfall can differ from the rate of inflow at the inlets at any time. A lag time has been introduced into the computer program to allow for utilization of storage available within the system. The writer agrees with the thought that the design flows at individual points may be found from intensities occurring when peak flows reach the points, but he disagrees with the thought that the design for flows between the points can be made for the same hydraulic grade at different times.

SECTION 5.

Storm water - Quality, Quantity, and Pollution

5a. Caused from combined overflows

5b. Caused from storm runoff

THERE ARE NO ABSTRACTS FOR THIS SECTION OF THE FIRST QUARTERLY ISSUE DUE TO A LACK OF INFORMATION PERTINENT TO THIS CATEGORY.

SECTION 6.

Surveys, Policies, and Reports

015
A REVIEW OF THE 1969 LITERATURE ON WASTEWATER AND WATER POLLUTION CONTROL: WASTEWATER AND STORM FLOW TREATMENT,

Research Committee
J Water Pollution Control Fed, Vol 42, No 6, pp 963-969, Jul 1970.
42 ref.

Descriptors: *Equipment, *Construction materials, *Treatment facilities, Overflow, Construction, Sewers, Technical feasibility, Sewerage, Storm runoff, Separation techniques, Water pollution.
Identifiers: *Treatment methods, Combined sewers.

This section of the review of 1969 literature discusses the construction of new sewerage systems and improvements made in existing systems in large and small cities. New construction methods, materials, and safety programs, are described along with new sewer maintenance and repair programs and methods, and new techniques and equipment for handling combined sewer overflows including rubber storage tanks, stabilization basins, regulators, treatment facilities, hydraulic additives, pressurized sewers, and the removal of downspout connections. The feasibility of sewer separation, pollution parameters from surface runoff, sewer project planning, and changes in sewer systems are other topics included in the literature review on wastewater and storm flow.

016
$37 BILLION: NEW PRICE TAG FOR CITIES' WATER POLLUTION CONTROL COSTS,

Nation's Cities, Vol 8, No 8, pp 8-9, Aug 1970.

Descriptors: *Estimated costs, *Cost allocation, *Cost analysis, *Cost comparisons, *Cost sharing, *Costs, *Cost trends, *Cities, *City planning, *Sewers, *Water resources development, *Legislation, Treatment facilities, Storm runoff, Overflow, Separation techniques.
Identifiers: *Storm sewers.

The National League of Cities (NLC) and the United States Conference of Mayors (USCM) estimated between $33 billion and $37 billion will be needed to combat water pollution between 1970 and 1976, as reported by Senator Muskie, in comparison with FWQA reports of $10 billion over the five year span, 1970-1974. The NLC-USCM survey asked for specific cost data categorized in the following manner: 1) needs for primary and secondary treatment facilities; 2) needs for tertiary treatment facilities; and, 3) needs for interceptor and storm sewers, including projected costs of separating storm and sanitary sewers, and/or storing storm water

overflows. The survey covered 1,008 communities with a combined population of approximately 89.4 million. Based on the projection from this survey, the NLC and USCM estimated the total national needs for state and local water pollution control facilities for the next six years which includes a five percent inflation factor. Discussion on past, present, and future legislative action is included, and a cost chart based on survey results is given.

017
STORM DRAINAGE FACILITIES, UNION COUNTY, NEW JERSEY,
Union County Planning Board, N. J.

May 1970. 97 p.

Descriptors: *Floods, *New Jersey, Drainage, Storms, Design, Storage.
Identifiers: *Union County, New Jersey, *Storm sewers.

The report presents an inventory and analysis of the storm drainage facilities of Union County, New Jersey. Points of analysis were generally selected where streams cross major County throughfares. The tributary area to each of these points was determined. Estimates of minimum design flows were prepared. These suggested minimum design flows were then used to determine the adequacy of the existing drainage facility at the point of analysis.

018
RECOMMENDED REGIONAL PLAN FOR SEWERAGE, WATER SUPPLY AND STORM DRAINAGE,
Valley Regional Planning Agency, Ansonia, Conn.

Feb 1970. 92 p.

Descriptors: *Urban planning, *Connecticut, Drainage, Floods, Control.
Identifiers: *Storm sewers, Water resources.

The report presents the recommended regional plan and program for sewerage, water supply, and storm drainage for the 58 square mile Valley Planning Region, comprising Ansonia, Derby, Seymour, and Shelton, Connecticut.

019
STORM DRAINAGE: INVENTORY AND ANALYSIS OF MAJOR EXISTING AND PLANNED FACILITIES; VOLUME V,
Valley Regional Planning Agency, Ansonia, Conn.

Feb 1970. 38 p.

Descriptors: *Urban planning, *Connecticut, *Sewers, Drainage, Floods, Sewage, Storm drains.

The fifth of a five-volume report that is being utilized as part of the basis for an areawide water/sewer plan and program for the Valley Region is detailed herein. This volume includes an inventory and evaluation of the major existing and planned facilities. The inventory includes a delineation of present areas served by storm sewers and areas requiring flood protection.

020
WATER SUPPLY AND SEWAGE DISPOSAL,
Rensselaer County Dept of Planning and Promotion, Troy, New York
1968. 128 p.

Descriptors: *Water supply, *Sewage disposal, Costs, Analysis, Drainage, Storms, Sewers.
Identifiers: *Rensselaer County, New York.

These facilities have been separately examined but are included in a single report. The section of water supply consists of a basic inventory of the existing water systems, their capacity, the number of people served, and the per capita consumption. Also presented is a cost analysis for each community serviced. The section on sewers and stormwater facilities, and explanations of the districts proposed by the County, one of the towns, and by three of the villages. Appropriate maps and cost estimates for the new districts are also included.

021
POLLUTION STINK FOULS CITY HALL,

K. W. Bennett
Iron Age, Vol 206, No 7, pp 73-75, Aug 13, 1970.

Descriptors: *Legislation, *Water pollution control, *Water quality control, *Industries, *Cities.
Identifiers: *Law enforcement, *Viewpoint.

Although legislation has been passed concerning water pollution control in relation to industries and municipalities, enforcement of these laws has been directed more towards industrial control. However, the number of states taking action against cities which are pollution violators is on the rise. The author views the economic plight which the city faces and gives some examples of pollution abatement programs and treatment facilities under construction in cities across the United States.

022
EFFECT OF SEASONAL EFFLUENT CHLORINATION ON COLIFORMS IN JAMAICA BAY,

R. T. Dewling, I. Seidenberg, and J. Kingery
J Water Pollution Control Fed, Vol 42, No 7, pp 1351-1361, Jul 1970.

Descriptors: *Investigations, *Chlorination, *Effluents, *Water pollution sources, *Water quality, *Data collections, *Coliforms, Analytical techniques, Overflow, Discharge measurement.
Identifiers: *Jamaica Bay, New York, Storm overflows, Combined sewers.

This article is a report on a study conducted to demonstrate that chlorination of wastewater treatment plant effluents would significantly improve the bacteriological quality of Jamaica Bay. A description of the investigation procedure, the Bay area, and its water uses and pollutants is given; water quality data collection analysis is detailed. The average daily discharge from storm and combined sewer overflows was calculated at about 34 million gallons based on a storm occurring at a frequency of about once every three days.

SECTION 7.

Legislation and Standards

023
CLEVELAND FACES POLLUTION SUIT,

Chemical Week, Vol 107, No 9, p 18, Aug 26, 1970.

Descriptors: *Legal aspects, *Water pollution sources, *Water pollution control, Lake Erie, Treatment facilities, City planning, Contracts, Sewers.
Identifiers: *Cleveland, Ohio.

The Ohio Water Pollution Control Board has directed Attorney General Paul Brown to file suit against Cleveland for failure in meeting a June 15, 1970 deadline to install temporary chlorination facilities in its sewage treatment plants which pollute Lake Erie. The city also failed to meet a July 1st deadline to contract for sanitary interceptor sewer plans in various parts of the city.

024
SEWER AND ENVIRONMENTAL ASPECTS OF WATER QUALITY STANDARDS,

Munehito Kuribayashi
Kogai to Taisaku, Vol 6, No 8, pp 631-634, Aug 15, 1970.

Descriptors: *Sewers, *Design, *Treatment facilities, *Waste treatment, Water quality, Standards, Drainage, Sewerage.
Identifiers: Japan.

Improvements of existing drainage systems and extensive development of drainage works are required on the present sewer systems in order to comply with new water quality standards. Large-scale sewerage works, planned on a basin area unit system, have more advantages because of the mixture of treated wastes produced. Advanced system engineering dealing with dynamic programming and multi-level-techniques will be employed in this sewer scheme which eventually may decide general water quality.

025
THE DESIGNATION OF THE AREA AND THE WATER QUALITY STANDARD OF THE RIVER KANO,

Yoji Ogawa
Kogai to Taisaku, Vol 6, No 7, pp 541-549, Jul 15, 1970.

Descriptors: *Water pollution sources, *Water quality control, *Standards, *Water pollution control, Urbanization.
Identifiers: *Japan, *Kano River Basin.

The Kano River Basin supports fresh water fish and the water is used for irrigation purposes. Industrial development and urban growth in the vicinity of the river basin have contributed to the water pollution problem. The Economic Planning Agency which investigated the quality of the basin water in the years 1966 and 1967 designated the water area and the water quality standard so as to maintain water quality control. By the year 1975, the pollution degree is estimated to decrease approximately 60% with water pollution control based on the new standard.

SECTION 8.

Treatment Methods and Reuse

026
PUMP INSTALLATION FOR SEWAGE,

Neth Patents +NL 6817242.

Descriptors: *Patents, *Sewerage, *Pumping plants, Overflow, Pipelines.

This installation is especially good for pumping sewage containing larger sized pieces without separation or processing. The collector feed pipe is connected in normal circumstances to the collecting reservoir by a feed pipe and a pump with its associated suction and delivery pipes. In exceptional conditions the system is connected via an overflow situated as close as possible above the feed pipe to the sewage pit and consists of an overflow pipe, horizontally below which is fixed a grid, and separated from the incoming liquid flow by a vertical baffle wall which lies along the diameter of the pit and above the feed pipe.

027
A PHYSICAL - CHEMICAL SYSTEM FOR TREATMENT OF COMBINED STORM SEWAGE,

Committee on Sewerage and Sewage Treatment, Ralph Stone (Chairman)
J Sanit Eng Div, Am Soc Civil Engrs, Vol 96, No SA4, Proc Paper 7477, pp 993-994, Aug 1970. Included in the article: "Sewerage and Sewage Treatment: State-of-the-Art Abstracts".

Descriptors: *Water pollution control, *Sewage treatment, *Activated carbon, *Pilot plants, Laboratory tests.
Identifiers: *Storm sewage.

This is a report on ongoing research, conducted by A. J. Shuckrow, G. W. Dawson, and A. T. Brix, covering enumeration and evaluation of the factors which should affect decisions as to the degree of water pollution control required in each specific situation. Powdered activated carbon may be utilized in a physical-chemical process for the treatment of combined storm sewage. The program involves laboratory development of the process, design and construction of a 100,000 gpd mobile pilot plant, and demonstration of the process. The process involves contacting the wastewater with powdered activated carbon and subsequent coagulation with alum and a polyelectrolyte followed by high-rate tube settling. The process appears to meed the following desirable characteristics for treatment of combined storm sewage: short detention time, intermittent use with capability to tolerate widely fluctuating flows and wastewater composition, small space requirements, high quality effluent, and economical operation. Based on the laboratory findings, the mobile pilot plant is being designed to fit into a

standard forty-foot trailer van with the exception of the carbon regeneration facility, which will be skid mounted. The system is designed for maximum operational flexibility and includes turbidity, pH, and flow measuring instruments in addition to the continuous organic carbon analyzer.

028
FIRESTONE INSTALLS POLLUTION CONTROL,

Oil Gas J, Vol 68, No 35, P 79, Aug 31, 1970.

Descriptors: *Water pollution control, *Treatment facilities, Control systems, Concrete construction, Separation techniques.
Identifiers: *Industrial treatment, *Storm water treatment.

A water pollution control system, which separates storm and industrial effluent and treats plant wastewater before release into the bayou, is being installed. This $8.8 million operation provides the Firestone plant with a separate industrial effluent collecting system and a separate storm water collecting system, thus the possibility of flushing the two systems together during a heavy rainfall is eliminated.

029
OZONATION, NEXT STEP TO WATER PURIFICATION,

Rene J. Bender
Power, Vol 114, No 8, pp 58-60, Aug 1970. 4 fig.

Descriptors: *Ozone, *Water purification, *Waste water treatment, Oxidation, Chlorination, Storm runoff.
Identifiers: *Overflow purification, Philadelphia.

Ozonation is an outstanding method for purifying water, because ozone is a superior oxidizing agent and oxidation helps clean water thoroughly. Workings of the two types of ozonators are diagrammed and described. Ozonation is not yet used in the U.S. to purify municipal drinking water because most state laws demand that chlorination be used. Ozonation does not replace chlorination, but it incorporates chlorine into its process in two forms. Ozonation kills bacteria and viruses faster than does chlorination; in addition, ozone does not affect water taste, and it eliminates the slight chlorine taste introduced during primary treatment. Ozonation costs about twice as much as chlorination, but both are very inexpensive. A U.S. trend is now towards ozonation of wastewater, and one pilot plant in Philadelphia is designed to purify combined sewer and stormwater discharge when flash floods cause untreated water and sanitary sewage to overflow into rivers. Additional uses of ozone in connection with wastewater are mentioned.

SECTION 9.

Hydrology

030
REAL-TIME COMPUTER CONTROL OF URBAN RUNOFF,

George Fleming and Robert L. McFall (discussion)
J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No HY9, pp 1908-1909, Sep 1970.

Original Paper: REAL-TIME COMPUTER CONTROL OF URBAN RUNOFF,
James J. Anderson
J Hydraulics Div, Am Soc Civil Engrs, Vol 96,
No HY1, pp 153-164, Jan 1970.

Descriptors: *Runoff, *Hydraulics, *Mathematical models, *Digital computers, Water management (applied).

Fleming: A method to calculate continuous runoff volumes preferred by the writer is to employ simulation techniques using the Hydrocomp Simulation Program which simulates the complete land phase of the hydrological cycle, and uses kinematic wave assumptions for flow in circular conduits. For purposes of the mathematical model a large scale computer could be assessed using the PDP-9 for data acquisition and control of automatic gates.
McFall: The writer would like to see a breakdown of costs into the categories of 1) capital outlay, 2) equipment operating, and 3) personnel cost.

031
URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD,

D. Earl Jones (discussion)
J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No HY9, pp 1879-1880, Sep 1970.

Original Paper: URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD,
Michael L. Terstriep and John B. Stall
J Hydraulics Div, Am Soc Civil Engrs, Vol 95,
No HY6, pp 1809-1834, Nov. 1969.

Descriptors: *Runoff forecasting, *Hydrographs, Methodology.
Identifiers: *RRL method.

The writer states that the Road Research Laboratory method provides a basis for evaluation of potential drainage area responses without prior extensive collection of local urban streamflow records furnishing a simple rationale for estimating flow hydrographs. The RRL model seems advantageous from the standpoints of simplicity, ease of application,

minimal data input requirements, and reasonable reliability of results in the common application range.

032
SURFACE RUNOFF FROM GRADED LANDS OF LOW SLOPES,

J. M. Laflen and I. L. Saveson
Trans Am Soc Agricultural Engrs, Vol 13, No 3, pp 340-341, 1970. 4 fig, 2 ref.

Descriptors: *Mathematical studies, *Data collections, *Surface runoff, Estimating equations, Storms, Louisiana.
Identifiers: *Data analysis.

This paper reports on analysis of surface runoff data collected during 1962, 1963, and 1964 near Baton Rouge, La. The object of the data analysis was to develop reliable prediction equations for estimating peak rate and total amount of surface runoff from any storm. The hypothesis tested was that peak rate and total amount of surface runoff could be expressed as functions of precipitation, row slope, row length, and antecedent soil moisture. Some conclusions drawn from the experiment include: 1) the effect of antecedent soil moisture is independent of precipitation, if the peak rate of runoff is the dependent variable; 2) the effect of slope and length of surface runoff is not independent of precipitation; 3) a single, precipitation - intensity measure is sufficient for expressing the effect of precipitation on peak rate of surface runoff.

033
SIMPLIFICATION OF INTEGRATED STORMWATER PLANNING FOR MODERN MULTIPLE LAND USE IN URBAN AND SUBURBAN DEVELOPMENTS,
Pennsylvania State University, University Park. Inst for Research on Land and Water Resources

Brian M. Reich
Mar 1970. 62 p. W70-07981, OWRR-B-010-PA(1), Contract DI-14-01-0001-1046.

Descriptors: *Hydrology, *Storms, Design, Drainage, Storage, Hydrographs, Watersheds.

Four synthetic hydrograph methods were applied on five watersheds in hopes of simplifying planning decisions for reserved space in valley bottoms of suburbia headwaters. Both hydrograph and routing procedures were programmed for digital computer evaluation for the more than 300 cases considered. General conclusions include the following: 1) no simple rules can be given on width of floodways to planners; 2) computer methods greatly facilitate routing and synthetic hydrograph computations; 3) a great need exists for data-based methods for predicting suburban design hydrographs in ungaged situations; and 4) a new course was developed on urban hydrology based on the studies results.

034
DATA ERROR EFFECTS IN UNIT HYDROGRAPH DERIVATION,

Krishan P. Singh (discussion)
J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No HY7, pp 1633-1636, Jul 1970. 1 tab, 2 ref.

Original Paper: DATA ERRORS EFFECTS IN UNIT HYDROGRAPH DERIVATION, Eric M. Laurenson and Terence O'Donnell
J Hydraulics Div, Am Soc Civil Engrs, Vol 95, No HY6, pp 1899-1917, Nov 1969.

Descriptors: *Unit hydrographs, *Methodology.
Identifiers: *Error analysis, *Data analysis.

The author comments upon the analysis of the errors of the first three of the four methods of unit hydrograph derivation studied in the original paper: (1) Laguerre Functions Method (LFM); (2) Harmonic Series Method (HSM); (3) Least Square Method (LSM); and (4) Gamma Distribution Method (GDM); when the basic data (the hyetograph and hydrograph) were in error. The mean errors, as a percentage, for the four methods of derivation using error-free data are presented in a table. Errors due to functional structure and flexibility of the methods are demonstrated. Further investigation is suggested concerning the fact that the derived unit hydrographs will differ more from the true ones for smaller durations of rainfall excess and errors in data.

035
URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD,

Leonard H. Watkins, Franklin F. Snyder, Harvey W. Duff, and George C. C. Hsieh (discussion)
J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No HY7, pp 1625-1631, Jul 1970. 2 tab, 4 ref.

Original Paper: URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD, Michael L. Terstriep and John B. Stall
J Hydraulics Div, Am Soc Civil Engrs, Vol 95, No HY6, pp 1809-1834, Nov 1969.

Descriptors: *Hydrographs, *Runoff coefficient, *Evaluation, Runoff, Rational formula, Storm runoff.
Identifiers: *RRL method, *Urban runoff.

The authors separately discuss aspects of the article included in a previous issue on an application of the Road Research Laboratory method (RRL) for synthesizing urban runoff hydrographs to conditions at three locations in the United States. Leonard Watkins describes the use of this method in Great Britain, concluding that the amounts of runoff found by the American authors agreed with experience in Great Britain. Frank Snyder discusses the theoretical applicability and other features of the RRL method, and he concludes that more analysis is needed in regard to

the assumption of a constant runoff coefficient equal to the percentage of impervious area connected to a storm drainage system. He also states that the applicability of the RRL method to urban basins with pervious and unconnected impervious areas for infrequent design storms is limited. Harvey Duff and George Hsieh compare the commonly-used rational method to the RRL method for predicting urban runoff. The RRL method seems to result in more accurate inflow predictions, but both methods predict runoff accurately. The rational method appears easier to use; and when the RRL method is tried, a shorter time increment is recommended.

SECTION 10.

Tunnels: Technology and Equipment

036
POTENTIAL IMPACT OF TUNNELS ON WATER POLLUTION AND FLOOD CONTROL IN THE CHICAGO AREA,

Forrest C. Neil
Paper presented at the Am Soc Civil Engrs Environ Meeting, Chicago, Oct 13-17, 1969. 21 p, 6 fig.

Descriptors: *Underground storage, *Tunnels, *Control structures, *Sewers, *Flood control, *Water pollution control, Drainage systems, Design, Storm runoff, Separation techniques.
Identifiers: *Chicago, Illinois.

A novel approach to the solution of water pollution and flood control problems in Chicago is described. It is part of a $2 billion, 10 year approach to meet water quality standards. The present combined sewer systems cannot handle the tremendous quantities of wastewater inputs during periods of precipitation when storm runoff is appreciable. Wastes discharged to the canal system, as a result of the overflows, are contributing to the pollution of Lake Michigan and the surrounding rivers. Sewer separation alone would not improve water quality in the waterways sufficiently to meet established standards. A separate sanitary sewer system would cost over 4 billion dollars. A system of deep tunnels for temporary subsurface storage of combined sewer overflows is desirable. This method could be achieved at less than 25% of the cost of sewer separation, using rock mole machines.

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1. Am City	1. The American City
2. Chemical Eng	2. Chemical Engineering
3. Chemical Week	3. Chemicl Week
4. Iron Age	4. Iron Age
5. J Hydraulics Div, Am Soc Civil Engrs	5. Journal of the Hydraulics Division, American Society of Civil Engineers
6. J Irrigation Drainage Div, Am Soc Civil Engrs	6. Journal of the Irrigation and Drainage Division, American Society of Civil Engineers
7. J Sanit Eng Div, Am Soc Civil Engrs	7. Journal of the Sanitary Engineering Division, American Society of Civil Engineers
8. J Water Pollution Control Fed	8. Journal of the Water Pollution Control Federation
9. Kogai to Taisaku	9. Kogai to Taisaku
10. Modern Power Eng	10. Modern Power Engineering
11. Nation's Cities	11. Nation's Cities
12. Oil Gas J	12. The Oil and Gas Journal
13. Power	13. Power
14. Public Works	14. Public Works
15. Trans, Am Soc Agr Engrs	15. Transactions, American Society of Agricultural Engineers

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